

**FINAL REPORT OF THE PLANNING CHARETTES
ON ENERGY-RELATED CHALLENGES AND OPPORTUNITIES
AT THE TRINITY COMMUNITY THEATER, PROVIDENCE, RI**

Presented to Trinity Restoration Inc.
Joseph E. Newsome, Lead CED Consultant

On March 20 and April 1, 2008, a broad-based team of building and energy experts assembled at the Trinity United Methodist Church to explore two topics: how the existing Trinity complex could be made more energy efficient in order to facilitate greater use of the existing facilities, and how an expansion and redevelopment of the property could employ state-of-the-art efficiency and renewable energy systems. Edward Connelly, an experienced charette leader who is the President of New Ecology, Inc., facilitated the charettes. New Ecology is a Cambridge Massachusetts based non-profit with expertise in catalyzing the sustainable development of community-based projects.

First Charette: March 20, 2008

The following agenda was distributed at the first charette, which was held on March 20, 2008.

Trinity United Methodist Church

Energy Charette Agenda

March 20, 2008

9AM-12 PM

- I. Welcome and Introductions - Ed Connelly (5 minutes)
- II. Charrette Objectives - Joe Newsome (10 minutes)
- III. Building Tour - Richardson Ogidan (20 minutes)
- IV. Discussion of Existing Conditions (90 minutes)
 - a. Current and desired programming uses of building spaces

- b. Review of 2 years of utility bills
 - c. Review of StudioJAED capital assessment
 - d. Discussion of known issues with HVAC system
 - i. System description
 - ii. Performance
 - iii. Zones
 - iv. Comfort level
 - e. Discussion of known building envelope issues
 - i. Air infiltration
 - ii. Stained glass/fenestration
 - iii. Insulation
 - f. Discussion of strategies for reducing consumption
 - i. Utility audits
 - ii. Energy Service Company involvement
 - iii. Retro commissioning
- V. Review of Site Master Plan – Don Richardson (20 minutes)
- VI. Discussion of Site Master Plan in Context of Existing Conditions (20 minutes)
- VII. Next Steps—Agenda for April 1 Meeting (15 minutes)

Prior to the meeting, a report from StudioJAED, a Delaware-based building consulting firm, was distributed to the attendees. The study, which was arranged by the Gilbane Building Company in order to assist Trinity Restoration Inc. (TRI), reviewed the structure and mechanical systems in order to propose possible energy conservation measures, and estimated the cost of some of the capital improvements that are needed.

In attendance at the first charrette were members of the TRI planning committee: Joseph Newsome (Ecolodgic Group, LLC), Richardson Ogidon (Trinity Church), Lynne Phipps (Design One Consortium), and Donald C. Richardson (DSR AIA & Associates). Also in attendance were Norman Cook (CCRI), Erin Anthony (intern from Mt. Ida College), Mark Nelson (SolarWrights), David Ward (Energy Engineering & Design) William Murray (William Murray Studios), Mark DiPetrillo (National Grid) and Bill Ferguson (RISE Engineering).

Mr. Connelly opened the charrette by welcoming everyone and explaining the agenda.

Mr. Newsome's described the purpose of the redevelopment efforts. The Redevelopment Planning Committee is seeking to promote reuse and redevelopment of the property as a community effort to show the possibilities for this type of property and to restore an underutilized historic site into a neighborhood asset. The ability to maintain the property as a house of worship is part of this vision, but it goes well beyond this to providing a mixed-use complex that can play a significant role in the revitalization of the community.

Currently, about 60% of the operating budget of the church is used to pay utilities. This financial burden is inhibiting expanded use of the site and jeopardizing the financial viability of the congregation. Mr. Newsome noted that the Committee is looking for the assistance of the group assembled today to advise on the development of a project that is "deeply rooted in the community, innovative, exciting, replicable and fundable."

Don Richardson, an architect who has worked on the site master plan for TRI, reviewed the layout and use of the existing property and the current programming, and discussed how this has informed his approach to redevelopment. The sanctuary is used as the place of worship for the Trinity UM Congregation; the theatre space is rented temporarily to another congregation. There are 8 built out offices in the basement below the theater that could be rented with modest improvement. A full-service kitchen, 4 additional offices and flexible program space (the fellowship hall) are other prominent features. A ¾ acre asphalt parking lot is very underutilized. Heating systems were replaced recently after a flood. The general construction is 4 courses of brick (16" wide walls) with no insulation in the walls. One electric meter serves the entire complex.

Mr. Richardson briefly described the master redevelopment plan that would include restoration of the theater (i.e., annex building), and could include the addition of a performing arts school building. The consensus of the group was that partnership with similar schools should be explored. Using the parking area as a "bright field" solar electric generating facility is also proposed.

The group was led on a tour of the complex by Richardson Ogidan. Notes from the Tour:

Fellowship Hall

- there is significant water damage due to deferred maintenance, window leakage, masonry issues and roof flashing issues
- stained glass windows are deteriorated and need overhaul
- there was a discussion of the most efficient way to restore the walls, windows, and plaster to make the space viable

Sanctuary

- one of only a few churches in RI that is fully sprinklered
- is in good condition
- has value as a performance venue, with good acoustics, seating 450
- no air conditioning and poor ventilation
- congregation desire air conditioning as the space is very hot in the summer
- has base board heat
- Ed C. mentioned that the existence of a ventilation system within the cupola/steeple should be explored as an alternative to air conditioning
-

Lower Level (under theater):

- several viable spaces in good condition
- minor work needed to make space rentable

Theater:

- the congregation that uses the space will be moving out by the end of June
- Don R. mentioned that the space is used infrequently
- the ceiling is thought to be insulated
- mezzanine suffers from significant water damage

Following the tour, the group reconvened to discuss the existing conditions and energy use. Mr. DiPetrillo provided an analysis of gas and electric use for the past two years and led the group in an analysis of usage. He stated that utility use is fairly modest. Mr. Ogidan explained that the congregation is under-heating the space to save money. Mr. DePetrillo noted that there is not a very high load factor and that the overall usage would change if the facility were used more extensively.

Key points gleaned from the usage analysis:

- The highest load was during the month of January (as expected)
- an estimate of KWH per sq. ft. in the church would be useful to compare Trinity to other RI churches from an electric usage standpoint
- Trinity has only one gas meter
- Hot water usage was discussed and it was determined that hot water is most often used for bathroom and kitchen use. One possible conservation measure would be

to only turn hot water on during weekends or periods of heavy use (to avoid standby losses).

- It was suggested that an energy model be conducted on the cost of operating the building.
- Windows and infiltration were mentioned as the two biggest loses on the site
- Don R. stated that an energy baseline is needed
- Richardson O. mentioned that there is an electric sub-meter for the sanctuary
- Ed C. suggested measuring the sub-meter the 2nd week of every month to determine the split of usage between the different buildings

The group discussed the condition and functionality of the existing HVAC system. Programmable thermostats are not present and were highly recommended, but Bill F. cautioned that steep setbacks in old buildings may cause the pipes to freeze.

Mark D. recommended finding the as-built drawings for the HVAC system. Dave W. recommended that someone takes a look at the building envelope for infiltration and mentioned a company called Zero Draft out of NY. Dave W. mentioned that thermal imaging to detect leakage could possibly be used. Joe N. noted that in the sanctuary there is significant leakage coming from the doors.

It was determined that RISE would come in and do a field audit of the building and report on the same at the next charette.

There was a deep discussion of the condition and possible options for repair of the stained glass windows. One of the threads of the conversation was whether it is more important to make the windows as efficient as possible or repair and preserve the longevity of the stained glass. This issue relates to whether interior or exterior storm windows are appropriate. As an expert in stained glass restoration, Bill M. recommends using an exterior storm because they protect the windows more than an interior storm. Joe N. mentioned his main concern regarding the windows is that they are energy efficient. A question was raised as to if the window frames/sashes could be modified in order to facilitate the best option for energy efficiency. Norman C. responded to the above question by stating that the State Historic Preservation Commission must be notified regarding this issue and that the alternative options should be presented to them. This is especially important if historic tax credits are pursued for the redevelopment.

Mr. Murray offered to prepare and distribute a report on the windows for the next charette.

The discussion shifted to the reuse possibilities presented in the draft site master plan.

In terms of producing energy on site, the group discussed TRI's goals for doing this. One aspiration is to produce more energy than is used or needed for the expanded buildings, exporting renewable energy to the community/grid. There was a discussion of the importance of ranking efficiency above energy generation and a discussion of the possibilities for making the Trinity campus a zero net energy site. From an overall sustainability standpoint, Mark N. stated that the first thing to do is reduce the wasteful usage and then supplement the site with the appropriate system(s). He also mentioned to look at these concepts from a long-term perspective.

The concepts of solar and geothermal systems were discussed in detail. Mark N. commented in saying that the current and projected energy usage will be needed to determine viability for either system. There was some discussion of considering 3rd party ownership for making solar more cost effective. In regards to geothermal use, Dave W. feels that it is not cost effective in a church (low occupancy) setting but is still worth looking into and states that a horizontal loop system would be possible.

The session concluded with a consensus that RISE/NGRID would conduct a more thorough audit of the existing buildings and systems, that the Studio JAED and stained glass reports would be discussed at the next meeting, and that in term of the campus master plan, there is a need to evaluate the energy requirements of an arts school and other buildings to see if on site generation is realistic.

Second Charrette: April 1, 2008

The second charrette was held at Trinity UM Church on April 1, 2008. The following agenda was distributed before the meeting:

Trinity United Methodist Church Energy Charette –Session 2 Agenda April 1, 2008 9AM-12 PM

- VIII. Welcome and Introductions - (5 minutes)
- IX. Day 2 Charette Objectives - (40 minutes)
 - a. Review StudioJAED study
 - b. Report from RISE/NGRID on audits
 - c. Plan for immediately addressing existing building energy use
- X. Discussion of Master Plan (120 minutes)
 - a. What should our goals be in terms of energy use?
 - i. Do we want to cool the church, the theater?
 - ii. Zero net energy
 - iii. Zero carbon
 - iv. Substantial reductions as an alternative
 - b. How does the master plan address these goals?
 - i. Discussion of district heating and cooling
 - ii. Regulatory issues with exporting power
 - c. Assessment of the Site Master Plan
 - i. Evaluation of geothermal system
 - 1. Costs
 - 2. Benefits
 - 3. Practicality
 - 4. Funding
 - ii. Evaluation of solar electric
 - 1. Costs
 - 2. Benefits
 - 3. Practicality
 - 4. Funding
 - iii. Other options

1. Combined heat and power
2. Solar thermal
3. Passive cooling
4. Valence cooling
5. Ice production

- XI. Next Steps (15 minutes)
- a. Agenda for next meeting
 - b. Continued involvement

In attendance at the second charrette were members of the TRI planning committee: Joseph Newsome (Ecolodgic Group, LLC), Richardson Ogidon (Trinity Church), Lynne Phipps (Design One Consortium), and Donald C. Richardson (DSR AIA & Associates). Also in attendance were Norman Cook (CCRI), Erin Anthony (Mt, Ida College), Mark Nelson (SolarWrights), David Ward (Energy Engineering & Design) William Murray (William Murray Studios), Mark DiPetrillo (National Grid), Bill Ferguson (RISE Engineering), Chris Fuller (RISE Engineering) and Jessica Miller (New Ecology).

Ed Connelly introduced the agenda and the goals for the day.

Joe Newsome stated that Gilbane would analyze and interpret the StudioJAED study and provide TRI with guidance on the costs of installing recommended improvements.

The team from RISE engineering and NGRID reported on their field audit of existing conditions, which was completed since the first charrettes. Chris Fuller (RISE), who led the audit team, distributed a detailed written report and discussed the findings. His primary points were:

- The HVAC equipment is nearly brand new, and is reasonably efficient, therefore replacement would not be recommended.
- The equipment may be oversized, as it appears to be short cycling (one of the three boilers is on for 5 minutes, off for 10 minutes). 85% efficient units, sizing is considerable ~3 million BTUs
- The heat timer controller to alternate which boiler of the 3 acts as lead unit should be checked to see if it is working properly.
- There are 3 fan coils in theater – all are on
- All areas heated to at least 60 degrees
- Baseboard units on separate thermostat

- Several manual thermostats in Theater
- Circulation pumps are running 24/7 and are fairly large, this is a source of electrical usage that could be improved.
- Piping is well insulated
- The control system needs to be reprogrammed based on building's current use
- Need to investigate summer gas consumption ~5% of total usage (avg. June – August), not sure why, it may be a leak? Example. July 116 therms used.
- 15 degree difference between floor and ceiling in Theater

There are improvements in the building envelope that would be easy to make and yield significant savings. These include:

- An access hatch to steeple is wide open (3ft x 3ft) causing hot air to rise through it—an insulated hatch should be made to fit the opening
- There are tremendous air leaks in sanctuary area near skylights. These should be sealed. Kalwall could replace the skylights – R value of 16?
- Sheathing under roof is missing in some places-should be replaced.
- The large vents in theater are old, don't seal well, controls/adjustments need to be looked at.
- The area most likely to be eligible for utility rebates is the insulation (roofs, ceilings) ~\$10k or 20% of cost could be rebated. If there are doubts about the state of the roof – choose rigid insulation; if the roof is in good shape, then choose cellulose - its fairly inexpensive and has air-sealing properties.
- There is a rebate incentive that could help with window replacement, but it is modest at \$1/sq.ft for glazing, cap 50% of project; however, National Grid may be able to up limits on insulation and windows for the project.
- 19,246 therms = current usage – could save 35% energy in ideal/perfect improvement scenario
- .5 therms/sq ft. in a year is average – if kept at a higher temp, use .6 (20% more)
- RISE could develop a system for insulation/weather stripping and do a thermography (Lynn notes that it is important to her to have the before and after numbers).

The next discussion centered on the best approach to fixing the stained glass windows. Bill Murray distributed his report and led the discussion. The primary discussion was how to fix the windows and make them energy efficient. The lead that holds the panes together in the stained glass has deteriorated and needs to be replaced. This type of stained glass windows are single pane, uninsulated glass, therefore a storm window is needed to improve performance. An interior storm would likely have the greatest affect on energy consumption; however, Bill recommends an outside storm as best preserving the restored stained glass (for moisture and rock damage). The following points were discussed:

- The goal is to restore the windows. Main issues are leakage and deterioration, missing glass
- Restoration of the lead – recrystallized quicker, adds ~100 years of durability
- Would add reinforcing rods in the lead channel
- Discussion of whether to insulate on both the inside and outside
- Support of adding protective glass on the outside – stained glass is the most expensive component (~\$125 sq. ft.), so it makes sense to make it last as long as possible
- Protective glass – c-sash type, ~\$10 sq/ft
- Frames are in really bad shape, many would need to be replaced.

Finally, Ed facilitated a discussion of master plan and larger technology goals. There was a discussion of the pros and cons of geothermal and solar applications for the campus. The high first cost of geothermal wells was identified as a limiting factor, but the combination of geothermal and solar PV (using the electricity produced by the PV to power the geothermal pumps and compressors) was identified as the best way to examine a zero energy complex.

The consensus of the group was that the construction of any new buildings should be kept simple, using state of the art building materials with a goal to reduce energy usage to a minimum, at which point the renewable energy features should be explored to provide this reduced level of power. The energy needs for the performing arts school must be better understood, but the project should be pursued as a high profile model of sustainable urban redevelopment.

Among the specific issues discussed were:

- Solar thermal (hot water) can reduce energy use by more than 35%
- 200 KW system of photovoltaics installed as a deck over the parking lot would cost approximately \$7-8 per KW or \$1.4 million for installation, and would produce about 240,000 kWh/year. Without modeling of energy use for geothermal or other applications it is not known whether this would power the entire complex or permit exporting power back to neighborhood. Determining this should be a goal of the design team.
- The project should be registered with USGBC for a LEED rating.
- Performing arts building should be designed to be expandable.

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List of Participants

Erin Anthony	Mount Ida College
Edward Connelly	New Ecology Inc.
Norman Cook	Community College of RI
Mark DiPetrillo	National Grid
William Ferguson	RISE Engineering
Chris Fuller	RISE Engineering
Jessica Miller	New Ecology Inc.
William Murray	William Murray Studios
Mark Nelson	SolarWrights
Joseph Newsome	Ecolodgic Group LLC
Richardson Ogidan	Trinity United Methodist Church
Lynne Bryan Phipps	Design One Consortium
Donald Richardson	DSR AIA & Associates
David Ward	Energy Engineering & Design



Mini-charette on March 20 on energy issues – Mr. Ed Connelly, New Ecology, facilitator

